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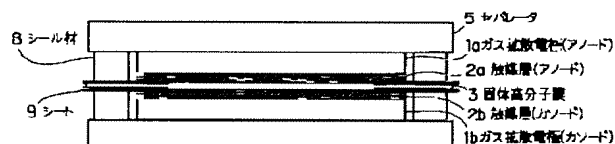
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(54)【発明の名称】 固体高分子電解質型燃料電池

(57)【要約】

【課題】 固体高分子膜に生じるせん断応力を低減させて膜の破断によるクロスリークを防止し、ガスシール性能を向上させることにより、長期運転可能な信頼性の高い固体高分子電解質型燃料電池を提供する。

【解決手段】 固体高分子膜3とシール材8との間から、固体高分子膜3とガス拡散電極1a、1bの触媒層2a、2bとの間の界面にわたって、シート9が挟まれるようにして配置されている。シート9は、厚さ25μmのテトラフルオロエチレン-パーフルオロアルキルビニルエーテル共重合体(PFA)から構成されている。



## 【特許請求の範囲】

【請求項1】 電解質層として固体高分子膜が設けられ、前記固体高分子膜を挟むようにしてカソード電極およびアノード電極からなる一対のガス拡散電極が配置され、前記ガス拡散電極を挟むようにしてガス不透過性の一対のセパレータが設置され、さらに前記固体高分子膜および前記セパレータに挟まれ且つ前記ガス拡散電極の外周部に接するようにならして一対のシール材が配置された固体高分子電解質型燃料電池において、前記固体高分子膜と前記シール材、および前記固体高分子膜と前記ガス拡散電極に挟まれて、シートが配置されたことを特徴とする固体高分子電解質型燃料電池。

【請求項2】 電解質層として固体高分子膜が設けられ、前記固体高分子膜を挟むようにしてカソード電極およびアノード電極からなる一対のガス拡散電極が配置され、前記ガス拡散電極を挟むようにしてガス不透過性の一対のセパレータが設置され、さらに前記セパレータの上面または下面に接すると共に前記固体高分子膜および前記ガス拡散電極の外周部に接するようにならして一対のシール材が配置された固体高分子電解質型燃料電池において、前記一対のシール材同士、および前記固体高分子膜と前記ガス拡散電極に挟まれて、シートが配置されたことを特徴とする固体高分子電解質型燃料電池。

【請求項3】 前記カソード電極側に配置された前記シートの幅寸法の方が、前記アノード電極側に配置された前記シートの幅寸法よりも長く設定されたことを特徴とする請求項1または2記載の固体高分子電解質型燃料電池。

【請求項4】 電解質層として固体高分子膜が設けられ、前記固体高分子膜を挟むようにしてカソード電極およびアノード電極からなる一対のガス拡散電極が配置され、前記ガス拡散電極を挟むようにしてガス不透過性の一対のセパレータが設置された固体高分子電解質型燃料電池において、前記固体高分子膜と前記セパレータに挟まれ、且つ前記ガス拡散電極の端部を覆うようにならして、断面がコ字形のシートが配置されたことを特徴とする固体高分子電解質型燃料電池。

【請求項5】 前記コ字形のシートの前記固体高分子膜と接する部分において、前記カソード電極側に配置された部分の幅寸法の方が前記アノード電極側に配置された部分の幅寸法よりも長く設定されたことを特徴とする請求項4記載の固体高分子電解質型燃料電池。

【請求項6】 前記ガス拡散電極には前記固体高分子膜に接する触媒層が設けられており、前記シートが前記触媒層の外周部に接するようにならして構成されたことを特徴とする請求項1、2、3、4または5記載の固体高分子電解質型燃料電池。

【請求項7】 前記シートがフッ素樹脂から構成された

ことを特徴とする請求項1、2、3、4、5または6記載の固体高分子電解質型燃料電池。

【請求項8】 電解質層として固体高分子膜が設けられ、前記固体高分子膜を挟むようにしてカソード電極およびアノード電極からなる一対のガス拡散電極が配置され、前記ガス拡散電極を挟むようにしてガス不透過性の一対のセパレータが設置された固体高分子電解質型燃料電池において、

前記ガス拡散電極の端部にコート材がコーティングされたことを特徴とする固体高分子電解質型燃料電池。

【請求項9】 前記カソード電極側にコーティングされた前記コート材の幅寸法の方が、前記アノード電極側にコーティングされた前記コート材の幅寸法よりも長く設定されたことを特徴とする請求項8記載の固体高分子電解質型燃料電池。

【請求項10】 前記コート材がフッ素樹脂またはガラスシール材料から構成されたことを特徴とする請求項8または9記載の固体高分子電解質型燃料電池。

【請求項11】 電解質層として固体高分子膜が設けられ、前記固体高分子膜を挟むようにしてカソード電極およびアノード電極からなる一対のガス拡散電極が配置され、前記ガス拡散電極を挟むようにしてガス不透過性の一対のセパレータが設置された固体高分子電解質型燃料電池において、

前記ガス拡散電極の端部に少なくともカーボン粉および水を有するインクが塗布、含浸されたことを特徴とする固体高分子電解質型燃料電池。

【請求項12】 前記カソード電極側に含浸された前記インクの幅寸法の方が、前記アノード電極側に含浸された前記インクの幅寸法よりも長く設定されたことを特徴とする請求項11記載の固体高分子電解質型燃料電池。

## 【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、固体高分子膜を電解質として用いた固体高分子電解質型燃料電池に係り、特に、ガスシール構造に改良を加えたものに関する。

【0002】

【従来の技術】近年、燃料の持つ化学エネルギーを直接電気エネルギーに変換する装置として、水素等の燃料と酸素等の酸化剤とによる電気化学反応を利用した燃料電池が注目を集めている。この燃料電池には様々なタイプが提案されているが、その1つとして、電解質に固体高分子膜を用いた固体高分子電解質型燃料電池が知られている。図18、図19は固体高分子電解質型燃料電池の構成を示したもので、以下にこの構成について説明する。

【0003】図に示すように、固体高分子電解質型燃料電池にはアノード電極1a、カソード電極1bからなる一対のガス拡散電極（多孔質カーボン製）が設けられており、各電極1a、1bにはそれぞれPt等からなる厚

さ30 $\mu$ mの触媒層2a、2bが形成されている。また電解質層として固体高分子膜3が設けられており、この膜3は触媒層2a、2bを介して電極1a、1bに挟まれるようにして配置されている。これら電極1a、1bおよび固体高分子膜3から単電池4が構成される。

【0004】また、単電池4を挟むようにしてガス不透過性のセパレータ5が設置されている。セパレータ5にはアノード電極1aに水素等の燃料ガスを、カソード電極1bに酸素等の酸化剤ガスを、それぞれ供給するためのガス流通溝が形成されている。さらに、固体高分子膜3とセパレータ5との間には電極1a、1bの外周部に接するバイトンゴム製のシール材8が設置されている。シール材8は系外へのガスリークを防止し、ガス利用率の低下および水素等の可燃性ガスによる爆発の危険を回避する働きを果たしている。

【0005】上記固体高分子膜3としては例えばフッ素系イオン交換膜であるパーフルオロスルホン酸膜などがある。固体高分子膜3は分子中に水素イオンの交換基を持ち、飽和含水することによりイオン伝導性物質として機能するようになっている。また、固体高分子膜3は電極1a、1bと供給される燃料ガスと酸化剤ガスとを分離するガス分離機能も有しており、電極1a、1b間でのクロスリーク（燃料ガスおよび酸化剤ガスの混合）による電圧低下を防いで、電池を長期的に運転させるようになっている。

【0006】以上のような構成を有する固体高分子電解質型燃料電池において、アノード電極1aに水素等の燃料ガスを供給し、カソード電極1bに酸素等の酸化剤ガスを供給することにより、電気化学反応が起き単電池4に起電力が生じる。なお、電極1a、1bに供給されるガスは、単電池4における相対湿度が100%となるように加湿されている。これは、イオン導電性の悪化を招く固体高分子膜3の乾燥を防ぐためである。

【0007】ところで、固体高分子電解質型燃料電池を実際に使用する場合、単電池4の起電力が通常1V以下と低いので、セパレータ5を介して単電池4を複数積層された単電池積層体6（図18に図示）とした上で、電池スタックとして使用している。このとき、単電池積層体6ごとに、冷媒を流通させる冷却板7を挿入しており、冷却板7の働きにより電気化学反応に伴って発生する余剰な熱を除去するようになっている。

【0008】

【発明が解決しようとする課題】上記の固体高分子電解質型燃料電池には、次にあげるような問題点があった。燃料電池の起動停止時や保管時、負荷変動時には固体高分子膜3の温度や含水量が変化するが、この変化に伴って固体高分子膜3が膨張あるいは収縮して固体高分子膜3にせん断応力が生じることがある。これに加えて、前段にて述べたように、固体高分子電解質型燃料電池は電池スタックとして使用しているので、スタック締め付け

時にシール材8によって固体高分子膜3がシールされる部分にせん断応力が発生した。

【0009】固体高分子膜3にせん断応力が生じ、さらには経時的な劣化が伴うと、固体高分子膜3が破断するおそれがあった。もし仮に固体高分子膜3が破断すると、燃料ガスと酸化剤ガスのクロスリークが発生して電圧が著しく低下し、電池の運転継続が不可能になるという不具合が生じた。

【0010】本発明は、このような問題点を解消するために提案されたものであり、固体高分子膜に生じるせん断応力を低減させて膜の破断によるクロスリークを防止し、ガスシール性能を向上させることにより、長期運転可能な信頼性の高い固体高分子電解質型燃料電池を提供するものである。

【0011】

【課題を解決するための手段】上記の目的を達成するために、請求項1に対応する固体高分子電解質型燃料電池は、電解質層として固体高分子膜が設けられ、前記固体高分子膜を挟むようにしてカソード電極およびアノード電極からなる一対のガス拡散電極が配置され、前記ガス拡散電極を挟むようにしてガス不透過性の一対のセパレータが設置され、さらに前記固体高分子膜および前記セパレータに挟まれ且つ前記ガス拡散電極の外周部に接するようにして一対のシール材が配置された固体高分子電解質型燃料電池において、前記固体高分子膜と前記シール材、および前記固体高分子膜と前記ガス拡散電極に挟まれて、シートが配置されたことを構成上の特徴としている。

【0012】上記の構成を有する請求項1の発明においては、シートが固体高分子膜を覆うので、シール材による固体高分子膜へのせん断応力を低減させることができ、膜の破断を防ぐことができる。しかも、シートが固体高分子膜のガス分離性能を補助することができる。そのため、ガスシール機能の信頼性が向上する。

【0013】請求項2に対応する固体高分子電解質型燃料電池は、電解質層として固体高分子膜が設けられ、前記固体高分子膜を挟むようにしてカソード電極およびアノード電極からなる一対のガス拡散電極が配置され、前記ガス拡散電極を挟むようにしてガス不透過性の一対のセパレータが設置され、さらに前記セパレータの上面または下面に接すると共に前記固体高分子膜および前記ガス拡散電極の外周部に接するようにして一対のシール材が配置された固体高分子電解質型燃料電池において、前記一対のシール材同士、および前記固体高分子膜と前記ガス拡散電極に挟まれて、シートが配置されたことを特徴とする。

【0014】上記構成を有する請求項2の発明では、シール材を固体高分子膜の外周部に接するように配置しているため、固体高分子膜の面積の縮小化によるコスト低減が可能であり、このような固体高分子電解質型燃料電池

池において請求項1の発明と同様の作用効果を発揮することができる。

【0015】請求項3に対応する固体高分子電解質型燃料電池は、請求項1または2記載の固体高分子電解質型燃料電池において、前記カソード電極側に配置された前記シートの幅寸法の方が、前記アノード電極側に配置された前記シートの幅寸法よりも長く設定されたことを特徴とする。

【0016】上記構成を有する請求項3の発明では、カソード電極側に配置されたシートの幅寸法を、アノード電極側に配置されたシートの幅寸法よりも長くしているので、アノード電極側で生成されたプロトンのカソード電極側への供給が阻害されることがない。そのため、 $C + 2H_2O \rightarrow CO_2 + 4H^+ + 4e^-$  といった反応による電極の腐食を防止することができる。つまり、電極の腐食を防ぎつつガス拡散電極に配置されるシートの幅を増加させてガスシール性能を高めることができ、加圧運転時や極間差圧が増大した場合等に対応することができる。

【0017】請求項4に対応する固体高分子電解質型燃料電池は、電解質層として固体高分子膜が設けられ、前記固体高分子膜を挟むようにしてカソード電極およびアノード電極からなる一対のガス拡散電極が配置され、前記ガス拡散電極を挟むようにしてガス不透過性の一対のセパレータが設置された固体高分子電解質型燃料電池において、前記固体高分子膜と前記セパレータに挟まれ、且つ前記ガス拡散電極の端部を覆うようにして、断面がコ字形のシートが配置されたことを特徴とする。

【0018】上記の構成にした請求項4の発明では、コ字形のシートの一部が固体高分子膜を覆うので、膜の破断防止とガス分離性能の向上を実現することができる。しかも、締め付けを行うシール材を別途設ける必要がなく、荷重も均等であるため、固体高分子膜の局所的なせん断応力を大幅に低減することが可能である。

【0019】請求項5に対応する固体高分子電解質型燃料電池は、前記コ字形のシートの前記固体高分子膜と接する部分において、前記カソード電極側に配置された部分の幅寸法の方が前記アノード電極側に配置された部分の幅寸法よりも長く設定されたことを特徴とする請求項4記載の固体高分子電解質型燃料電池である。

【0020】このような構成を有する請求項5の発明においては、上記請求項3の発明と同じように、アノード側で生成されたプロトンのカソード側への供給阻害による電極の腐食発生を防ぎつつ、ガス拡散電極に配置されるシートの幅を増加させてガスシール性能を高めることができる。

【0021】請求項6に対応する固体高分子電解質型燃料電池は、請求項1、2、3、4または5記載の固体高分子電解質型燃料電池において、前記ガス拡散電極には前記固体高分子膜に接する触媒層が設けられており、前

記シートが前記触媒層の外周部に接するように構成されたことを特徴とする。

【0022】このような構成を有する請求項6の発明においては、シートを触媒層の外周部に接するように構成するので、シートの厚さを触媒層の厚さと同じ程度にまで増加させることができる。したがって、シートにおける強度や極間差圧の耐性を高めることができ、ガスシール機能の信頼性が向上する。

【0023】請求項7に対応する固体高分子電解質型燃料電池は、請求項1、2、3、4、5及び6記載の固体高分子電解質型燃料電池において、前記シートがフッ素樹脂から構成されたことを特徴とする。フッ素樹脂は耐熱性、耐酸性、耐水性に優れているため、上記構成にすることによりシートの耐久性の向上を図ることができる。

【0024】請求項8に対応する固体高分子電解質型燃料電池は、電解質層として固体高分子膜が設けられ、前記固体高分子膜を挟むようにしてカソード電極およびアノード電極からなる一対のガス拡散電極が配置され、前記ガス拡散電極を挟むようにしてガス不透過性の一対のセパレータが設置された固体高分子電解質型燃料電池において、前記ガス拡散電極の端部にコート材がコーティングされたことを特徴とする。

【0025】上記構成の請求項8の発明によれば、コート材が固体高分子膜の端部を覆うことができるので、ガス分離性能の向上を図ることができる。さらに、締め付けを行うシール材を別途設ける必要がなく、荷重も均等となるので、固体高分子膜の局所的なせん断応力の発生を防いで、固体高分子膜の破断を防止できる。

【0026】請求項9に対応する固体高分子電解質型燃料電池は、前記カソード電極側にコーティングされた前記コート材の幅寸法の方が、前記アノード電極側にコーティングされた前記コート材の幅寸法よりも長く設定されたことを特徴とする請求項8記載の固体高分子電解質型燃料電池である。

【0027】上記構成を持つ請求項9の発明においては、上記請求項3および5の発明と同じく、アノード側で生成されたプロトンのカソード側への供給がスムーズに行われるので電極が腐食することがなく、ガス拡散電極に配置されるコート材の幅を十分に増加させてガスシール性能を高めることができる。

【0028】請求項10に対応する固体高分子電解質型燃料電池は、請求項8または9記載の固体高分子電解質型燃料電池において、前記コート材がフッ素樹脂またはガラスシール材料から構成されたことを特徴としている。このような構成を有する発明では、コーティング箇所の耐酸性および耐熱性が向上し、ガスシール性能が高まるといった作用効果がある。

【0029】請求項11に対応する固体高分子電解質型燃料電池は、電解質層として固体高分子膜が設けられ、

前記固体高分子膜を挟むようにしてカソード電極およびアノード電極からなる一対のガス拡散電極が配置され、前記ガス拡散電極を挟むようにしてガス不透過性の一対のセパレータが設置された固体高分子電解質型燃料電池において、前記ガス拡散電極の端部に少なくともカーボン粉および水を有するインクが塗布、含浸されたことを特徴とする。

【0030】上記の構成を有する請求項11の発明においては、少なくともカーボン粉および水を有するインクを含浸することで、ガス拡散電極の端部を親水処理することができる。さらに電極の端部では、電気化学反応が生じないため、反応部と比べて温度が低くなる。すなわち、反応部の温度において相対湿度が100%である加湿ガスが電極端部に供給されることにより、電極端部では水の凝縮が生じ、常にウェットシールされることになる。よって、シール材で締め付けを行うシール部を別途設ける必要がなく、荷重も均等である。そのため、固体高分子膜の局所的なせん断応力が発生せず、固体高分子膜の破断を防止できる。

【0031】請求項12に対応する固体高分子電解質型燃料電池は、前記カソード電極側に含浸された前記インクの幅寸法の方が、前記アノード電極側に含浸された前記インクの幅寸法よりも長く設定されたことを特徴とする請求項11記載の固体高分子電解質型燃料電池である。上記の構成により、前述した請求項3、5および9の発明と同様、アノード側で生成されたプロトンのカソード側への供給の阻害を防いで電極の腐食を防ぐことができる。したがって、ガス拡散電極に配置されるシートの幅を増加させてガスシール性能を高めることができる。

#### 【0032】

【発明の実施の形態】以下、本発明の実施の形態の一例について、図面を参照して具体的に説明する。なお、図18および図19にて示した従来技術と同一の部材に関しては同一符号を付し、説明は省略する。

#### 【0033】(1)第1の実施形態

〔構成〕第1の実施形態は請求項1、7に対応するものであり、図19の従来例と同様、固体高分子膜3およびセパレータ5に挟まれ且つガス拡散電極1a、1bの外周部に接するようにしてシール材8が配置された固体高分子電解質型燃料電池に適用されるものである。図1は第1の実施形態にかかる単電池構造を表した断面図、図2は単電池構造を示した分解図である。

【0034】図1に示すように、固体高分子膜3とシール材8との間から、固体高分子膜3とガス拡散電極1a、1bの触媒層2a、2bとの間の界面にわたって、シート9が挟まれるようにして配置されている。シート9は、厚さ25 $\mu$ mのテトラフルオロエチレン-パーフルオロアルキルビニルエーテル共重合体(PFA)からなり、温度120℃、プレス圧20kgf/cm<sup>2</sup>で1

5分間ホットプレスされたものである。

【0035】なお、図2に示すように、セパレータ5にはアノード電極1aに水素等の燃料ガスを、カソード電極1bに酸素等の酸化剤ガスを、それぞれ供給するためのガス流通溝13が形成されている。また、各部材におけるシール部分には燃料ガス用、酸化剤ガス用、および冷却水用のマニホールド12a、12b及び12cがそれぞれ設けられている。

【0036】〔作用効果〕上記の構成を有する第1の実施形態においては、単電池4のシール部分において挟持させたシート9が固体高分子膜3を覆い、シール部分近傍にかかるせん断応力を低減させることができる。したがって、固体高分子膜3が破断するのを防ぐことができる。しかも、シート9はPFA製であるため、強度が強く、耐久性に優れているため、膜3のガス分解機能を補助することができ、ガスシール機能の信頼性が格段に向上する。より具体的には、ガスシール機能が少なくとも10,000時間維持されていることを確認した。このような第1の実施形態によれば、ガスシール性能が向上するため、固体高分子電解質型燃料電池の信頼性向上、長寿命化を図ることが可能となる。なお、第1の実施形態の変形例として、図3のようにシート9をガス拡散電極1a、1bと触媒層2a、2bの界面に挟持しても同様な作用効果が得られる。

#### 【0037】(2)第2の実施形態

〔構成〕第2の実施形態は請求項2、7に対応するもので、セパレータ5の上面または下面に接すると共に固体高分子膜3およびガス拡散電極1a、1bの外周部に接するようにしてシール材8が配置された固体高分子電解質型燃料電池に適用されるものである。このような実施形態と上記第1の実施形態との相違点は、実施形態の固体高分子膜3の方がシール部分まで延長されておらず、使用面積が縮小化されている点にある。第2の実施形態では、図4の断面図に示すように、一対のシール材8、8同士の間から、固体高分子膜3とガス拡散電極1a、1bの触媒層2a、2bとの間にわたって、シート9が挟まれるようにして配置されたことを特徴としている。

【0038】〔作用効果〕上記構造にすることにより、第2の実施形態においてはシール材8を固体高分子膜3の外周部に接するように配置しているため、使用する固体高分子膜3の面積の縮小化を図り、コスト低減に貢献可能であり、このような固体高分子電解質型燃料電池において上記第1の実施形態と同様の作用効果を発揮することができる。

#### 【0039】(3)第3の実施形態

〔構成〕第3の実施形態は請求項3、7に対応するものであり、前記第1の実施形態の構成に加え、図5に示すようにカソード電極1b側に配置されたシート9の幅寸法の方が、アノード電極1a側に配置されたシート9の幅寸法よりも長く設定されたことを構成上の特徴とす

る。

【0040】〔作用効果〕上記構成を有する第3の実施形態では、カソード電極1b側に配置されたシート9の幅寸法を、アノード電極1a側に配置されたシート9の幅寸法よりも長くすることで、アノード電極1a側で生成したプロトンのカソード電極1b側へスムーズに供給することができる。そのため、 $C + 2H_2O \rightarrow CO_2 + 4H^+ + 4e^-$  といった反応による電極の腐食を防止できると同時に、シート9の幅を増加させてガスシール性能を高めることができる。したがって、加圧運転時や極間差圧が増大した場合等に即座に対応可能である。

#### 【0041】(4) 第4の実施形態

〔構成〕第4の実施形態は請求項4、7に対応するものであり、シール材8が用いない固体高分子電解質型燃料電池に適用されるものである。図6は第4の実施形態にかかる単電池構造を表した断面図、図7は単電池構造を示した分解図である。

【0042】図6に示すように、第4の実施形態では、固体高分子膜3とセパレータ5に挟まれ、且つガス拡散電極1a、1bの端部を覆うようにして、断面がコ字形のシート91が配置されたことを特徴とする。このシート91は厚さ25 $\mu m$ のトラフルオロエチレン-パーフルオロアルキルビニルエーテル共重合体(PFA)から構成されている。なお、ガス拡散電極1a、1bとシート91の界面にはフッ素グリースが塗られ、両者の界面がシールされている。

【0043】〔作用効果〕上記の構成にした第4の実施形態においては、シート91の一部が固体高分子膜3を覆っており、しかも、締め付けを行うシール材8を設けていないので、固体高分子膜3に対する局所的なせん断応力を大幅に低減することができ、固体高分子膜3の破断を確実に防止してガスシール性能の向上を図ることができる。具体的には、ガスシール機能が10,000時間維持されていることが確認されている。このような実施の形態によれば、ガスシール性能が向上するため、固体高分子電解質型燃料電池の信頼性向上、長寿命化を図ることが可能となる。

#### 【0044】(5) 第5の実施形態

〔構成〕第5の実施形態は請求項6に対応するもので、図8に示すように前記第1の実施形態の構成に加えて、触媒層2a、2bがガス拡散電極1a、1bよりも1回り小さく設けられており、この触媒層2a、2bの外周部にシート9が接するように構成されたことを特徴としている。

【0045】〔作用効果〕このような構成を有する第5の実施形態においては、シート9の厚さを触媒層2a、2bの厚さと同じ程度にまで増加させることができる。したがって、シート9における強度や極間差圧の耐性を高めることが可能となり、ガスシール機能の信頼性が向上する。この結果、固体高分子電解質型燃料電池の信頼

性向上、長寿命化が可能となる。一方、極間差圧の耐性の増加はガス流速の増加や負荷変動を可能にするため、固体高分子電解質型燃料電池の高性能化につながる。

【0046】なお、第5の実施形態の変形例としては、前記第2の実施形態においてシート9が触媒層2a、2bの外周部に接するもの(図9参照)や、前記第3の実施形態においてシート9が触媒層2a、2bの外周部に接するもの(図10参照)、さらには第2の実施形態に請求項3および6の特徴を合わせ持つもの(図11参照)などがある。図11の実施形態とは、固体高分子膜3がシール部分まで延長されていない燃料電池において、シート9が触媒層2a、2bの外周部に接し、且つカソード電極1b側に配置されたシート9の幅寸法の方がアノード電極1a側に配置されたシート9の幅寸法よりも長く設定されたものである。

#### 【0047】(6) 第6の実施形態

〔構成〕第6の実施形態は請求項4、5、6に対応するもので、図12に示すように、前記第4の実施形態においてカソード電極1b側に配置されたシート91が触媒層2a、2bの外周部に接し、且つシート91の固体高分子膜3と接する部分において、カソード電極1b側に配置された部分の幅寸法の方がアノード電極1a側に配置された部分の幅寸法よりも長く設定されたことを特徴としている。

【0048】〔作用効果〕このような構成を有する第6の実施形態においては、上記第3、4、5の実施形態の持つ作用効果を合わせ持つことができる。なお、第6の実施形態の変形例としては、図13に示すように、電極1a、1b側に配置されたシート91が両方とも触媒層2a、2bの外周部に接するように構成されたものなどがある。

#### 【0049】(7) 第7の実施形態

〔構成〕第7の実施形態は請求項8、10に対応するものであり、図14は第7の実施形態の単電池構造を示した断面図である。図14に示すように、予めガス拡散電極1a、1bの多孔質カーボン板部分の端部に、テトラフルオロエチレン-ヘキサフルオロプロピレンのエナメル(ネオフロンND-2)が塗布されており、360℃で熱処理が行われ、厚さが50 $\mu m$ になるコート材10がコーティングされている。さらに、ガス拡散電極1a、1bに厚さ30 $\mu m$ の触媒層2a、2bが塗布され、第1の実施形態と同様な条件で固体高分子膜3と共にホットプレスされ、セパレータ5にて保持される。

【0050】〔作用効果〕上記構成を有する第7の実施形態によれば、コート材10が固体高分子膜3の端部を覆うので、ガス分離性能が向上する。さらに、締め付けを行うシール材を別途設ける必要がなく、荷重も均等となるため、固体高分子膜3の局所的なせん断応力の発生を防ぎ、固体高分子膜の破断を確実に防止してクロスリークを防止できる。具体的にはガスシール機能が10,

000時間維持されていることを確認した。このような本実施の形態によれば、ガスシール性能が向上するため、固体高分子電解質型燃料電池の信頼性向上、長寿命化、信頼性向上が可能となる。

#### 【0051】(8) 第8の実施形態

〔構成〕第8の実施形態は請求項9、10に対応するもので、図15に示すように、カソード電極1b側にコーティングされたコート材10の幅寸法の方が、アノード電極1a側にコーティングされたコート材10の幅寸法よりも長く設定されたことを特徴とする。

【0052】〔作用効果〕上記構成を持つ第8の実施形態においては、上記第3の実施形態と同じく、アノード側で生成されたプロトンのカソード側への供給をスムーズに行うことができる。したがって、加圧運転時や極間差圧が増大した場合等によりシール性能を高めるために、コート材10のコーティング部分の幅寸法を増加させた場合でも、アノードで生成されたプロトンのカソード側への供給の障害を防ぎ、電極の腐食を防止できる。本実施の形態によれば、シール性能を高める必要が生じた場合において、腐食を防止でき、固体高分子電解質型燃料電池の電池の信頼性が高まる。

#### 【0053】(9) 第9の実施形態

〔構成〕第9の実施形態は請求項11に対応するものであり、図16は第9の実施形態の単電池構造を示した断面図である。図16に示すように、触媒層2a、2bを塗布したガス拡散電極1a、1bの端部に、カーボン粉(Vulcan XC-72R)、界面活性材、純水からなるインク11が塗布され(固形分67%)、120℃で乾燥処理される。その後、第1の実施の形態と同様な条件で固体高分子膜3とホットプレスが行われ、セパレータ5にて保持されている。

【0054】〔作用効果〕上記の構成を有する第9の実施形態においては、カーボンからなるインク11を含浸することで、ガス拡散電極1a、1bの端部を親水処理することができる。さらに電極1a、1bの端部では、電気化学反応が生じないため、反応部と比べて温度が低くなる。つまり、反応部の温度において相対湿度が100%である加湿ガスが電極1a、1bの端部に供給されることにより、電極1a、1b端部にて水の凝縮が生じ、常にウェットシールされることになる。よって、シール材で締め付けを行うシール部を別途設ける必要がなく、荷重も均等である。そのため、固体高分子膜3における局所的なせん断応力が発生せず、固体高分子膜3の破断を防止できる。具体的には、ガスシール機能が10,000時間維持されていることを確認した。以上のような本実施の形態によれば、ガスシール性能が向上し、固体高分子電解質型燃料電池の信頼性向上、長寿命化が可能となる。

#### 【0055】(10) 第10の実施の形態

〔構成〕第10の実施形態は請求項12に対応するもの

で、図17に示すように、カソード電極1b側の端部のインク11の幅寸法が、アノード電極1a側に含浸された端部のインク11の幅寸法よりも長く設定されたことを特徴としたものである。

【0056】〔作用効果〕上記の第10の実施形態においては、上記第3および第8の実施形態と同じく、アノード側で生成されたプロトンのカソード側への供給をスムーズに行うことができるので、アノードで生成されたプロトンのカソード側への供給の障害を防いで電極の腐食を防止しつつ、インク11の幅寸法を増加させた場合でも、できる。本実施の形態によれば、シール性能を高める必要が生じた場合において、腐食を防止でき、固体高分子電解質型燃料電池の電池の信頼性が高まる。

#### 【0057】(11) 他の実施形態

上述した実施の形態では、シート9、91としてテトラフルオロエチレン-パーフルオロアルキルビニルエーテル共重合体(PFA)を用いたが、他にポリテトラフルオロエチレン(PTFE)、テトラフルオロエチレン-ヘキサフルオロプロピレン共重合体(FEP)等のフッ素樹脂やバイトンゴムやシリコンゴム製のシートを用いても良い。また、コート材10としては、ポリテトラフルオロエチレンエナメルやガラスコート材を用いても同様な効果がある。さらに、コート材を塗布する代わりに、ポリテトラフルオロエチレン(PTFE)、テトラフルオロエチレン-ヘキサフルオロプロピレン共重合体(FEP)またはテトラフルオロエチレン-パーフルオロアルキルビニルエーテル共重合体(PFA)のシートを熱融着しても同様な効果を得ることができる。

#### 【0058】

【発明の効果】以上説明したように、本発明によれば、固体高分子膜のシール部近傍におけるスタック締め付け時に発生するシール材によるせん断応力や、起動停止時や保管時、負荷変動時の固体高分子電解質膜の温度、含水量の変化に伴う膨脹、収縮に起因するせん断応力を低減させることにより、経時的な固体高分子電解質膜の劣化に伴う膜の破断によるクロスリークを防止し、ガスシール性能を向上させることが可能なので、長期運転可能な信頼性の高い固体高分子電解質型燃料電池を得ることができる。

#### 【図面の簡単な説明】

【図1】本発明の第1の実施形態にかかる単電池構造を表した断面図

【図2】図1の単電池構造を示した分解図

【図3】第1の実施形態の変形例の断面図

【図4】本発明の第2の実施形態にかかる単電池構造を表した断面図

【図5】本発明の第3の実施形態にかかる単電池構造を表した断面図

【図6】本発明の第4の実施形態にかかる単電池構造を表した断面図

【図7】図6の単電池構造を示した分解図

【図8】本発明の第5の実施形態にかかる単電池構造を表した断面図

【図9】第5の実施形態の変形例の断面図

【図10】第5の実施形態の変形例の断面図

【図11】第5の実施形態の変形例の断面図

【図12】本発明の第6の実施形態にかかる単電池構造を表した断面図

【図13】第6の実施形態の変形例の断面図

【図14】本発明の第7の実施形態にかかる単電池構造を表した断面図

【図15】本発明の第8の実施形態にかかる単電池構造を表した断面図

【図16】本発明の第9の実施形態にかかる単電池構造を表した断面図

【図17】本発明の第10の実施形態にかかる単電池構造を表した断面図

【図18】従来の固体高分子電解質型燃料電池積層体の断面図

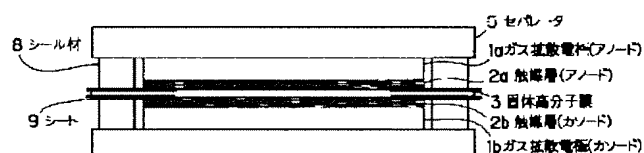
【図19】従来の固体高分子電解質型燃料電池の単電池

構造を表した断面図

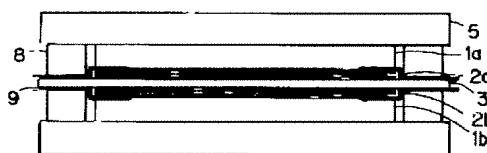
【符号の説明】

- 1 a…ガス拡散電極(アノード)
- 1 b…ガス拡散電極(カソード)
- 2 a…触媒層(アノード)
- 2 b…触媒層(カソード)
- 3…固体高分子膜
- 4…単電池
- 5…セパレータ
- 6…単電池積層体
- 7…冷却板
- 8…シール材
- 9, 9 1…シート
- 1 0…コート材
- 1 1…インク
- 1 2 a…マニホールド(燃料ガス用)
- 1 2 b…マニホールド(酸化剤ガス用)
- 1 2 c…マニホールド(冷却水用)
- 1 3…ガス流通溝

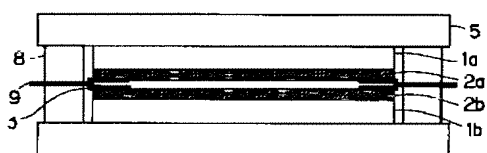
【図1】



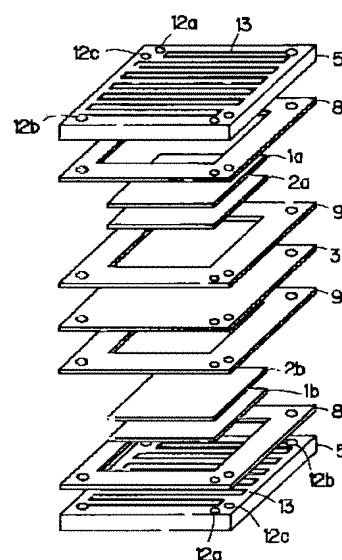
【図3】



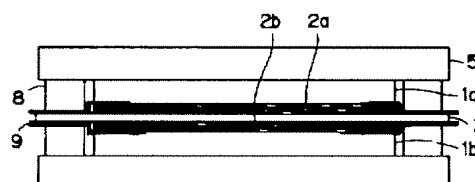
【図4】



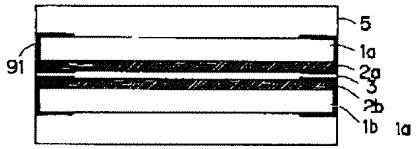
【図2】



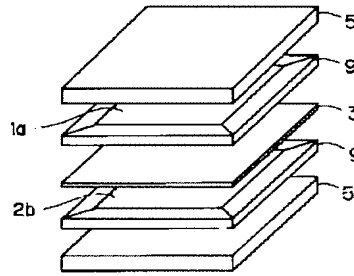
【図5】



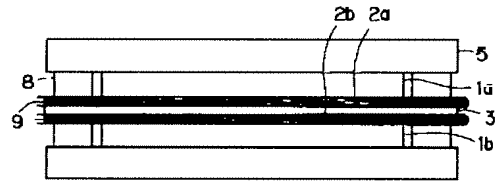
【図6】



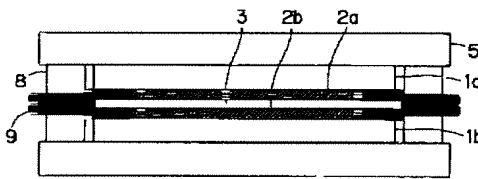
【図7】



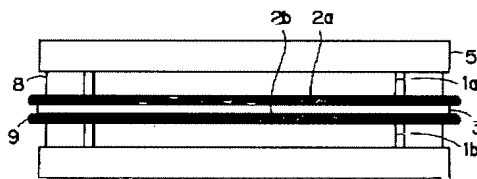
【図8】



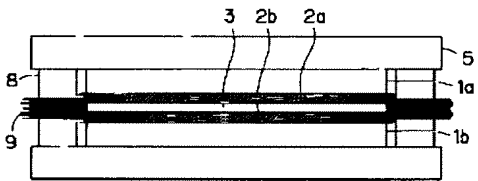
【図9】



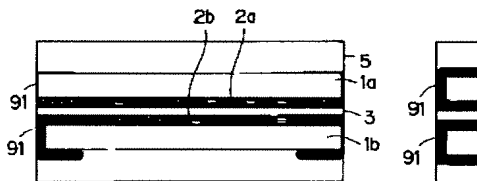
【図10】



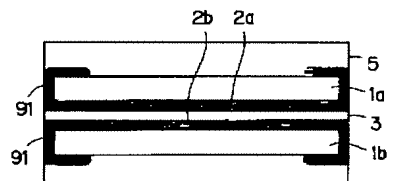
【図11】



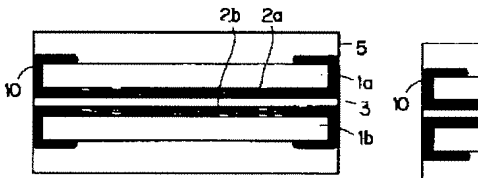
【図12】



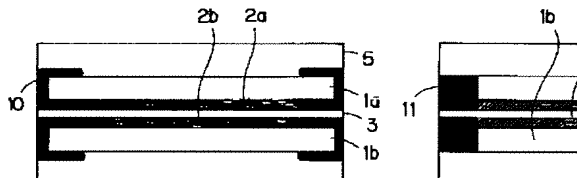
【図13】



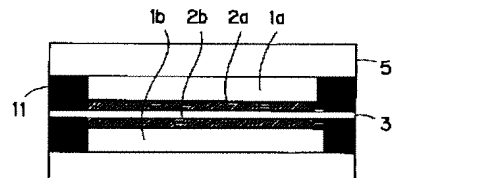
【図14】



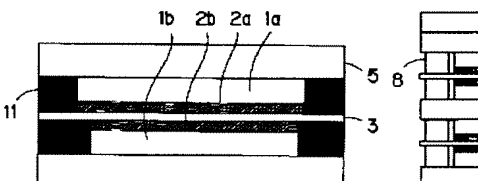
【図15】



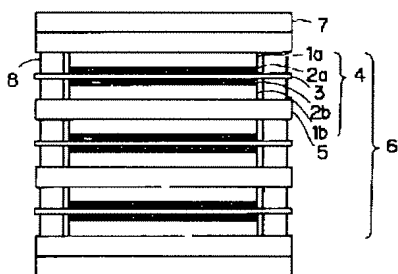
【図16】



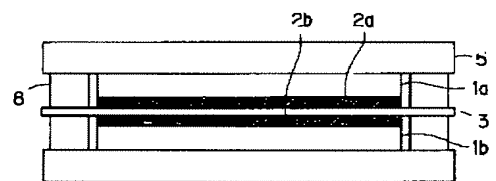
【図17】



【図18】



【図19】



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JAPANESE

LEGAL  
STATUS

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## PATENT ABSTRACTS OF JAPAN

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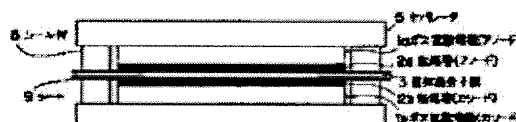
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## (54) SOLID POLYELECTROLYTE FUEL CELL

## (57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a solid polyelectrolyte fuel cell which is capable of operating for long period and having high reliability by reducing shearing stresses generated in a solid polymeric film so as to prevent cross leakages due to the breakage of the film, and enhancing gas sealing capability.

**SOLUTION:** A sheet 9 is disposed in such a manner as to be held inbetween from a solid polymeric film 3 and a sealant 8 to the interface between the solid polymeric film 3 and catalyst layers 2a, 2b of gas diffused electrodes 1a, 1b. The sheet 9 is constituted of a tetrafluoroethylene-perfluoroalkylvinyl ether copolymer (PFA) having a thickness of 25  $\mu$  m.



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CLAIMS

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[Claim(s)]

[Claim 1]A gas diffusion electrode of a couple which consists of a cathode terminal and an anode electrode as solid polymer membrane is provided as an electrolyte layer and sandwiches said solid polymer membrane is arranged, As said gas diffusion electrode is inserted, a separator of a gas impermeability couple is installed, In a solid polyelectrolyte type fuel cell with which a sealant of a couple has been arranged as it was furthermore inserted into said solid polymer membrane and said separator and a peripheral part of said gas diffusion electrode was touched, A solid polyelectrolyte type fuel cell, wherein it was inserted into said solid polymer membrane, said sealant, and said solid polymer membrane and said gas diffusion electrode and a sheet has been arranged.

[Claim 2]A gas diffusion electrode of a couple which consists of a cathode terminal and an anode electrode as solid polymer membrane is provided as an electrolyte layer and sandwiches said solid polymer membrane is arranged, As said gas diffusion electrode is inserted, a separator of a gas impermeability couple is installed, In a solid polyelectrolyte type fuel cell with which the upper surface or the undersurface of said separator was furthermore touched, and a sealant of a couple has been arranged as a peripheral part of said solid polymer membrane and said gas diffusion electrode was touched, A solid polyelectrolyte type fuel cell, wherein it was inserted into sealants, and said solid polymer membrane and said gas diffusion electrode of said couple and a sheet has been arranged.

[Claim 3]The solid polyelectrolyte type fuel cell according to claim 1 or 2, wherein a direction of a width dimension of said sheet arranged at said cathode terminal side is set up for a long time than a width dimension of said sheet arranged at said anode electrode side.

[Claim 4]A gas diffusion electrode of a couple which consists of a cathode terminal and an anode electrode as solid polymer membrane is provided as an electrolyte layer and sandwiches said solid polymer membrane is arranged, In a solid polyelectrolyte type fuel cell with which a separator of a gas impermeability couple was installed as sandwiched said gas diffusion electrode, A solid polyelectrolyte type fuel cell with which a section is characterized by having arranged a sheet of KO type as is inserted into said solid polymer membrane and said separator and covers an end of said gas diffusion electrode.

[Claim 5]The solid polyelectrolyte type fuel cell according to claim 4, wherein a direction of a width dimension of a portion arranged at said cathode terminal side is set up in a portion which touches said solid polymer membrane of a sheet of said KO type for a long time than a width dimension of a portion arranged at said anode electrode side.

[Claim 6]The solid polyelectrolyte type fuel cell according to claim 1, 2, 3, 4, or 5 constituting so that a catalyst bed which touches said solid polymer membrane may be provided in said gas diffusion electrode and said sheet may touch a peripheral part of said catalyst bed.

[Claim 7]The solid polyelectrolyte type fuel cell according to claim 1, 2, 3, 4, 5, or 6, wherein said sheet comprises a fluoro-resin.

[Claim 8]A gas diffusion electrode of a couple which consists of a cathode terminal and an anode electrode as solid polymer membrane is provided as an electrolyte layer and sandwiches said solid polymer membrane is arranged, A solid polyelectrolyte type fuel cell, wherein an end of said

gas diffusion electrode is coated with coat material in a solid polyelectrolyte type fuel cell with which a separator of a gas impermeability couple was installed as sandwiched said gas diffusion electrode.

[Claim 9]The solid polyelectrolyte type fuel cell according to claim 8, wherein a direction of a width dimension of said coat material with which said cathode terminal side was coated is set up for a long time than a width dimension of said coat material with which said anode electrode side was coated.

[Claim 10]The solid polyelectrolyte type fuel cell according to claim 8 or 9, wherein said coat material comprises a fluoro-resin or a charge of a glass seal material.

[Claim 11]A gas diffusion electrode of a couple which consists of a cathode terminal and an anode electrode as solid polymer membrane is provided as an electrolyte layer and sandwiches said solid polymer membrane is arranged, A solid polyelectrolyte type fuel cell which having applied ink which has carbon powder and water at least at the end of said gas diffusion electrode, and impregnating it in a solid polyelectrolyte type fuel cell with which a separator of a gas impermeability couple was installed as sandwiched said gas diffusion electrode.

[Claim 12]The solid polyelectrolyte type fuel cell according to claim 11, wherein a direction of a width dimension of said ink impregnated at said cathode terminal side is set up for a long time than a width dimension of said ink impregnated at said anode electrode side.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to the solid polyelectrolyte type fuel cell which used solid polymer membrane as an electrolyte, and relates to what added improvement to gas sealing structure especially.

[0002]

[Description of the Prior Art]In recent years, the fuel cell which used the electrochemical reaction by fuel, such as hydrogen, and oxidizers, such as oxygen, as a device which transforms into electrical energy directly the chemical energy which fuel has attracts attention. Although various types are proposed by this fuel cell, the solid polyelectrolyte type fuel cell which used solid polymer membrane for the electrolyte is known as one of them. Drawing 18 and drawing 19 are what showed the composition of the solid polyelectrolyte type fuel cell, and explain this composition below.

[0003]As shown in a figure, the gas diffusion electrode (product made from porous carbon) of the couple which consists of the anode electrode 1a and the cathode terminal 1b is provided in the solid polyelectrolyte type fuel cell, and the catalyst bed 2a with a thickness of 30 micrometers which consists of Pt(s) etc., respectively, and 2b are formed in each electrodes 1a and 1b. The solid polymer membrane 3 is formed as an electrolyte layer, and this film 3 is pinched by the electrodes 1a and 1b via the catalyst bed 2a and 2b, and is made and arranged. The cell 4 comprises these electrodes 1a and 1b and the solid polymer membrane 3.

[0004]As the cell 4 is inserted, the gas impermeability separator 5 is installed. The gas distribution groove for supplying fuel gas, such as hydrogen, to the anode electrode 1a, and supplying oxidant gas, such as oxygen, to the cathode terminal 1b, respectively is formed in the separator 5. Between the solid polymer membrane 3 and the separator 5, the sealant 8 made of Viton rubber which touches the peripheral part of the electrodes 1a and 1b is installed. The sealant 8 prevented the gas leak to the outside of a system, and has achieved the work which avoids the danger of explosion by combustible gas, such as decline in the rate of gas utilization, and hydrogen.

[0005]There are a perfluoro sulfonic acid film etc. which are for example, fluorine system ion-exchange membranes as the above-mentioned solid polymer membrane 3. The solid polymer membrane 3 has an exchange group of a hydrogen ion in a molecule, and functions as an ion-conductive substance by carrying out saturation water. The solid polymer membrane 3 also has the gas separating function to separate the electrodes 1a and 1b, the fuel gas supplied, and oxidant gas, prevents the electrode 1a and the sag by the cross leakage (mixing of fuel gas and oxidant gas) between 1b, and makes a cell operate in the long run.

[0006]In the solid polyelectrolyte type fuel cell which has the above composition, by supplying fuel gas, such as hydrogen, to the anode electrode 1a, and supplying oxidant gas, such as oxygen, to the cathode terminal 1b, electrochemical reaction occurs and electromotive force arises in the cell 4. The gas supplied to the electrodes 1a and 1b is humidified so that the relative humidity in the cell 4 may be 100%. This is for preventing the desiccation of the solid polymer membrane 3 which causes aggravation of ion conductivity.

[0007]By the way, after making the cell 4 into the cell layered product 6 (it illustrates to drawing 18) by which plural laminates were carried out via the separator 5 since the electromotive force of the cell 4 was usually as low as less than 1V when a solid polyelectrolyte type fuel cell is actually used, it is used as a cell stack. At this time, the cold plate 7 which circulates a refrigerant is inserted every cell layered product 6, and the surplus heat generated in connection with electrochemical reaction by work of the cold plate 7 is removed.

[0008]

[Problem(s) to be Solved by the Invention]There was a problem which is raised to the next in the above-mentioned solid polyelectrolyte type fuel cell. Although the temperature and water content of the solid polymer membrane 3 change at the time of a load change at the time of the deactivation of a fuel cell, and storage, it may follow on this change, the solid polymer membrane 3 may expand or contract, and shearing stress may arise in the solid polymer membrane 3. In addition, since the solid polyelectrolyte type fuel cell was used as a cell stack as the preceding paragraph described, shearing stress occurred into the portion to which the seal of the solid polymer membrane 3 is carried out by the sealant 8 at the time of stack bolting.

[0009]When shearing stress arose in the solid polymer membrane 3 and still more nearly temporal degradation followed, there was a possibility that the solid polymer membrane 3 might fracture. If the solid polymer membrane 3 fractured, the cross leakage of fuel gas and oxidant gas occurred, voltage fell remarkably, and the fault that the driving continuation of a cell became impossible arose.

[0010]This invention is proposed in order to cancel such a problem, and it is a thing. the purpose is to provide a solid polyelectrolyte type fuel cell with high reliability in which long-term operation is possible by reducing the shearing stress boiled and produced, preventing the cross leakage by membranous fracture, and raising gas-seal performance.

[0011]

[Means for Solving the Problem]In order to attain the above-mentioned purpose, a solid polyelectrolyte type fuel cell corresponding to Claim 1, A gas diffusion electrode of a couple which consists of a cathode terminal and an anode electrode as solid polymer membrane is provided as an electrolyte layer and sandwiches said solid polymer membrane is arranged, As said gas diffusion electrode is inserted, a separator of a gas impermeability couple is installed, In a solid polyelectrolyte type fuel cell with which a sealant of a couple has been arranged as it was furthermore inserted into said solid polymer membrane and said separator and a peripheral part of said gas diffusion electrode was touched, It is characterized [ constitutional ] by having been inserted into said solid polymer membrane, said sealant, and said solid polymer membrane and said gas diffusion electrode, and having arranged a sheet.

[0012]In an invention of Claim 1 which has the above-mentioned composition, a sheet is that of a wrap about a solid polymer membrane, shearing stress to solid polymer membrane by a sealant can be reduced, and a membranous fracture can be prevented. And a sheet can assist gas separating performance of solid polymer membrane. Therefore, the reliability of a gas-seal function improves.

[0013]A solid polyelectrolyte type fuel cell corresponding to Claim 2, A gas diffusion electrode of a couple which consists of a cathode terminal and an anode electrode as solid polymer membrane is provided as an electrolyte layer and sandwiches said solid polymer membrane is arranged, As said gas diffusion electrode is inserted, a separator of a gas impermeability couple is installed, In a solid polyelectrolyte type fuel cell with which the upper surface or the undersurface of said separator was furthermore touched, and a sealant of a couple has been arranged as a peripheral part of said solid polymer membrane and said gas diffusion electrode was touched, It was inserted into sealants, and said solid polymer membrane and said gas diffusion electrode of said couple, and a sheet has been arranged.

[0014]Since a sealant is arranged in an invention of Claim 2 which has the above-mentioned composition so that a peripheral part of solid polymer membrane may be touched, Cost reduction by reduction of area of solid polymer membrane is possible, and the same operation effect as an invention of Claim 1 can be demonstrated in such a solid polyelectrolyte type fuel cell.

[0015]A solid polyelectrolyte type fuel cell corresponding to Claim 3 was set up in the solid polyelectrolyte type fuel cell according to claim 1 or 2 for a long time than a width dimension of said sheet in which a direction of a width dimension of said sheet arranged at said cathode terminal side has been arranged at said anode electrode side.

[0016]In an invention of Claim 3 which has the above-mentioned composition, since a width dimension of a sheet arranged at the cathode terminal side is made longer than a width dimension of a sheet arranged at the anode electrode side, supply by the side of a cathode terminal of a proton generated by the anode electrode side is not checked. Therefore,  $C+2H_2O \rightarrow CO_2 + 4H^+$  Corrosion of an electrode by the reaction  $+4e^-$  can be prevented. That is, when width of a sheet arranged at a gas diffusion electrode is made to increase, the gas-seal performance can be improved and the time of application-of-pressure operation and electrode differential pressure increase, preventing corrosion of an electrode, it can respond.

[0017]A solid polyelectrolyte type fuel cell corresponding to Claim 4, A gas diffusion electrode of a couple which consists of a cathode terminal and an anode electrode as solid polymer membrane is provided as an electrolyte layer and sandwiches said solid polymer membrane is arranged, In a solid polyelectrolyte type fuel cell with which a separator of a gas impermeability couple was installed as sandwiched said gas diffusion electrode, as it was inserted into said solid polymer membrane and said separator and an end of said gas diffusion electrode was covered, a sheet of KO type has been arranged for a section.

[0018]In an invention of Claim 4 carried out to the above-mentioned composition, some sheets of KO type can realize improvement in membranous prevention from a fracture, and gas separating performance for solid polymer membrane by that of a wrap. And it is not necessary to provide separately a sealant [ bolting / a sealant ], and since load is also equivalent, it is possible to reduce local shearing stress of solid polymer membrane substantially.

[0019]A solid polyelectrolyte type fuel cell corresponding to Claim 5, In a portion which touches said solid polymer membrane of a sheet of said KO type, a direction of a width dimension of a portion arranged at said cathode terminal side is the solid polyelectrolyte type fuel cell according to claim 4 setting up for a long time than a width dimension of a portion arranged at said anode electrode side.

[0020]In an invention of Claim 5 which has such composition, preventing corrosion generating of an electrode by supply inhibition by the side of a cathode of a proton generated by the anode side like an invention of above-mentioned Claim 3, width of a sheet arranged at a gas diffusion electrode is made to increase, and gas-seal performance can be improved.

[0021]A solid polyelectrolyte type fuel cell corresponding to Claim 6, In the solid polyelectrolyte type fuel cell according to claim 1, 2, 3, 4, or 5, a catalyst bed which touches said solid polymer membrane is provided in said gas diffusion electrode, and it was constituted so that said sheet might touch a peripheral part of said catalyst bed.

[0022]Since a sheet is constituted so that a peripheral part of a catalyst bed may be touched, thickness of a sheet can be made to increase even to the same grade as thickness of a catalyst bed in an invention of Claim 6 which has such composition. Therefore, the tolerance of intensity in a sheet or electrode differential pressure can be improved, and the reliability of a gas-seal function improves.

[0023]In Claims 1, 2, 3 and 4 and a solid polyelectrolyte type fuel cell given in 5 and 6, as for a solid polyelectrolyte type fuel cell corresponding to Claim 7, said sheet comprised a fluoro-resin. Since a fluoro-resin is excellent in heat resistance, acid resistance, and a water resisting property, it can aim at improvement in the endurance of a sheet by having the above-mentioned composition.

[0024]A solid polyelectrolyte type fuel cell corresponding to Claim 8, A gas diffusion electrode of a couple which consists of a cathode terminal and an anode electrode as solid polymer membrane is provided as an electrolyte layer and sandwiches said solid polymer membrane is arranged, An end of said gas diffusion electrode was coated with coat material in a solid polyelectrolyte type fuel cell with which a separator of a gas impermeability couple was installed as sandwiched said gas diffusion electrode.

[0025]Since coat material can cover an end of solid polymer membrane according to the

invention of Claim 8 of the above-mentioned composition, improvement in gas separating performance can be aimed at. Since it becomes do not need to provide separately a sealant [ bolting / a sealant ] and equivalent [ load ], generating of local shearing stress of solid polymer membrane is prevented, and a fracture of solid polymer membrane can be prevented.

[0026]A solid polyelectrolyte type fuel cell corresponding to Claim 9, A direction of a width dimension of said coat material with which said cathode terminal side was coated is the solid polyelectrolyte type fuel cell according to claim 8 setting up for a long time than a width dimension of said coat material with which said anode electrode side was coated.

[0027]In an invention of Claim 9 which it has, the above-mentioned composition as well as above-mentioned Claim 3 and an invention of 5, Since supply by the side of a cathode of a proton generated by the anode side is performed smoothly, an electrode does not corrode, width of coat material arranged at a gas diffusion electrode is made to fully increase, and gas-seal performance can be improved.

[0028]A solid polyelectrolyte type fuel cell corresponding to Claim 10 is characterized by said coat material comprising a fluoro-resin or a charge of a glass seal material in the solid polyelectrolyte type fuel cell according to claim 8 or 9. In an invention which has such composition, acid resistance and heat resistance of a coating part improve, and there is a operation effect that gas-seal performance increases.

[0029]A solid polyelectrolyte type fuel cell corresponding to Claim 11, A gas diffusion electrode of a couple which consists of a cathode terminal and an anode electrode as solid polymer membrane is provided as an electrolyte layer and sandwiches said solid polymer membrane is arranged, In a solid polyelectrolyte type fuel cell with which a separator of a gas impermeability couple was installed as sandwiched said gas diffusion electrode, ink which has carbon powder and water at least at the end of said gas diffusion electrode was applied, and it was impregnated.

[0030]In an invention of Claim 11 which has the above-mentioned composition, hydrophilic processing of the end of a gas diffusion electrode can be carried out by ink which has carbon powder and water at least being impregnated. Furthermore, at the end of an electrode, since electrochemical reaction does not arise, compared with a reaction part, temperature becomes low. That is, by supplying humidification gas whose relative humidity is 100% to an electrode end part at temperature of a reaction part, in an electrode end part, condensation of water will arise and a wet seal will always be carried out. Therefore, it is not necessary to provide separately a seal part [ bolting / a seal part / a sealant ], and load is also equivalent. Therefore, local shearing stress of solid polymer membrane does not occur, but a fracture of solid polymer membrane can be prevented.

[0031]A solid polyelectrolyte type fuel cell corresponding to Claim 12 is the solid polyelectrolyte type fuel cell according to claim 11, wherein a direction of a width dimension of said ink impregnated at said cathode terminal side is set up for a long time than a width dimension of said ink impregnated at said anode electrode side. By the above-mentioned composition, inhibition of supply to the cathode side of a proton generated by the anode side can be prevented like Claim 3 mentioned above and an invention of 5 and 9, and corrosion of an electrode can be prevented. Therefore, width of a sheet arranged at a gas diffusion electrode is made to increase, and gas-seal performance can be improved.

[0032]

[Embodiment of the Invention]Hereafter, an example of an embodiment of the invention is concretely explained with reference to Drawings. Identical codes are attached about the same member as the conventional technology shown by drawing 18 and drawing 19, and explanation is omitted.

[0033](1) A 1st embodiment [ 1st ] of an embodiment [composition] is Claim 1 and a thing corresponding to 7, It is applied to the solid polyelectrolyte type fuel cell with which the sealant 8 has been arranged as it was inserted into the solid polymer membrane 3 and the separator 5 and the peripheral part of the gas diffusion electrodes 1a and 1b was touched like the conventional example of drawing 19. The sectional view showing the cell structure which drawing 1 requires for a 1st embodiment, and drawing 2 are the exploded views showing cell structure.

[0034]As shown in drawing 1, from between the solid polymer membrane 3 and the sealants 8, covering the interface between the solid polymer membrane 3, and the catalyst bed 2a of the gas diffusion electrodes 1a and 1b and 2b, the sheet 9 is inserted, and it is made and arranged. The sheet 9 consists of a 25-micrometer-thick tetrafluoroethylene perfluoroalkyl vinyl ether copolymer (PFA), and a hotpress is carried out for 15 minutes by the temperature of 120 \*\*, and press pressure 20 kgf/cm<sup>2</sup>.

[0035]As shown in drawing 2, the gas distribution groove 13 for supplying fuel gas, such as hydrogen, to the anode electrode 1a, and supplying oxidant gas, such as oxygen, to the cathode terminal 1b, respectively is formed in the separator 5. The object for fuel gas, the object for oxidant gas, and the manifolds 12a, 12b, and 12c for cooling water are formed in the seal part in each member, respectively.

[0036][Function and Effect] -- in a 1st embodiment that has the composition of the account of a top, the sheet 9 made to pinch in the seal part of the cell 4 can cover the solid polymer membrane 3, and the shearing stress applied near the seal part can be reduced. Therefore, it can prevent the solid polymer membrane 3 fracturing. and since it is a product made from PFA, its intensity is strong, and since it excels in endurance, the sheet 9 can assist the gas disassembler of the film 3, and the reliability of a gas-seal function boils it markedly, and improves. More specifically, it checked that the gas-seal function was maintained for at least 10,000 hours. According to such a 1st embodiment, since gas-seal performance improves, it becomes possible to attain improvement in reliability of a solid polyelectrolyte type fuel cell, and reinforcement. Even if it pinches the sheet 9 like drawing 3 as a modification of a 1st embodiment to the interface of the gas diffusion electrodes 1a and 1b, the catalyst bed 2a, and 2b, the same operation effect is obtained.

[0037](2) A 2nd embodiment [ 2nd ] of an embodiment [composition] is Claim 2 and a thing corresponding to 7, The upper surface or the undersurface of the separator 5 is touched, and it is applied to the solid polyelectrolyte type fuel cell with which the sealant 8 has been arranged as the peripheral part of the solid polymer membrane 3 and the gas diffusion electrodes 1a and 1b was touched. The direction of the solid polymer membrane 3 of an embodiment is not extended to a seal part, but the point of difference of such an embodiment and a 1st embodiment of the above is at the point that reduction of the operating area is carried out. According to a 2nd embodiment, as shown in the sectional view of drawing 4, it is characterized by having inserted the sheet 9, having made and having been arranged from between the sealant 8 of a couple, and eight comrades, over the solid polymer membrane 3, and the catalyst bed 2a of the gas diffusion electrodes 1a and 1b and 2b.

[0038][Function and Effect], since the sealant 8 is arranged in a 2nd embodiment by using account structure of a top so that the peripheral part of the solid polymer membrane 3 may be touched, Reduction of the area of the solid polymer membrane 3 to be used can be attained, it can contribute to cost reduction, and the same operation effect as a 1st embodiment of the above can be demonstrated in such a solid polyelectrolyte type fuel cell.

[0039](3) A 3rd embodiment [ 3rd ] of an embodiment [composition] is Claim 3 and a thing corresponding to 7, In addition to the composition of said 1st embodiment, the direction of the width dimension of the sheet 9 arranged at the cathode terminal 1b side as shown in drawing 5 is characterized [ constitutional ] by being set up for a long time than the width dimension of the sheet 9 arranged at the anode electrode 1a side.

[0040][Function and Effect] -- in a 3rd embodiment that has account composition of a top. The proton generated by the anode electrode 1a side can be smoothly supplied to the cathode terminal 1b side by making longer than the width dimension of the sheet 9 arranged at the anode electrode 1a side the width dimension of the sheet b9 arranged at the cathode terminal 1b side. Therefore,  $C+2H_2O \rightarrow CO_2 + 4H^+$  While the corrosion of the electrode by the reaction  $+4e^-$  can be prevented, the width of the sheet 9 is made to increase and gas-seal performance can be improved. Therefore, when the time of application-of-pressure operation and electrode differential pressure increase, it can respond immediately.

[0041](4) A 4th embodiment [ 4th ] of an embodiment [composition] corresponds to Claim 4 and 7, and is applied to the solid polyelectrolyte type fuel cell which the sealant 8 does not use. The

sectional view showing the cell structure which drawing 6 requires for a 4th embodiment, and drawing 7 are the exploded views showing cell structure.

[0042]As shown in drawing 6, as it was inserted into the solid polymer membrane 3 and the separator 5 and the end of the gas diffusion electrodes 1a and 1b was covered, in a 4th embodiment, the sheet 91 of KO type has been arranged for the section. This sheet 91 comprises a 25-micrometer-thick TORAFURUORO ethylene-perfluoroalkyl vinyl ether copolymer (PFA). Fluorine grease is applied to the interface of the gas diffusion electrodes 1a and 1b and the sheet 91, and the seal of both interface is carried out.

[0043][Function and Effect] — in a 4th embodiment made the composition of the account of a top, Some sheets 91 have covered the solid polymer membrane 3, since the sealant [ bolting / the sealant ] 8 moreover is not formed, the local shearing stress to the solid polymer membrane 3 can be reduced substantially, the fracture of the solid polymer membrane 3 can be prevented certainly, and improvement in gas-seal performance can be aimed at. Specifically, it is checked that the gas-seal function is maintained for 10,000 hours. According to such an embodiment, since gas-seal performance improves, it becomes possible to attain improvement in reliability of a solid polyelectrolyte type fuel cell, and reinforcement.

[0044](5) A 5th embodiment [ 5th ] of an embodiment [composition] is a thing corresponding to Claim 6, As shown in drawing 8, in addition to the composition of said 1st embodiment, the catalyst bed 2a and 2b are small provided the 1 surroundings rather than the gas diffusion electrodes 1a and 1b, and it is characterized by being constituted so that the sheet 9 may touch the peripheral part of this catalyst bed 2a and 2b.

[0045][Function and Effect] — the thickness of the sheet 9 can be made to increase even to the catalyst bed 2a and the same grade as the thickness of 2b in a 5th embodiment that has such composition Therefore, it becomes possible to improve the tolerance of the intensity in the sheet 9, or electrode differential pressure, and the reliability of a gas-seal function improves. As a result, the improvement in reliability of a solid polyelectrolyte type fuel cell and reinforcement are attained. On the other hand, the increase in the tolerance of electrode differential pressure leads to highly efficient-ization of a solid polyelectrolyte type fuel cell in order to make possible an increase and load change of a gas flow rate.

[0046]As a modification of a 5th embodiment, the sheet 9 in said 2nd embodiment The catalyst bed 2a, There are what touches the peripheral part of 2b (refer to drawing 9), that (refer to drawing 10) whose sheet 9 touches the peripheral part of the catalyst bed 2a and 2b in said 3rd embodiment, the thing (refer to drawing 11) which has Claim 3 and the feature of 6 in a 2nd embodiment further, etc. In the fuel cell with which the solid polymer membrane 3 is not extended to the seal part with the embodiment of drawing 11, The direction of the width dimension of the sheet 9 which the sheet 9 touched the peripheral part of the catalyst bed 2a and 2b, and has been arranged at the cathode terminal 1b side is set up for a long time than the width dimension of the sheet 9 arranged at the anode electrode 1a side.

[0047](6) A 6th embodiment [ 6th ] of an embodiment [composition] is a thing corresponding to Claims 4, 5 and 6, In the portion which the sheet 91 arranged in said 4th embodiment at the cathode terminal 1b side touches the peripheral part of the catalyst bed 2a and 2b, and touches the solid polymer membrane 3 of the sheet 91 as shown in drawing 12, The direction of the width dimension of the portion arranged at the cathode terminal 1b side is characterized by being set up for a long time than the width dimension of the portion arranged at the anode electrode 1a side.

[0048][Function and Effect] — in a 6th embodiment that has such composition, it can have a operation effect which the 3rd, 4, and 5 above-mentioned embodiment has. As a modification of a 6th embodiment, as shown in drawing 13, there are some etc. which were constituted so that the electrode 1a and the sheet 91 arranged at theb [ 1 ] side might touch the peripheral part of the catalyst bed 2a and 2b in both.

[0049](7) A 7th embodiment [ 7th ] of an embodiment [composition] corresponds to Claim 8 and 10, and drawing 14 is a sectional view showing the cell structure of a 7th embodiment. As shown in drawing 14, beforehand at the end of the porous carbon plate part of the gas diffusion electrodes 1a and 1b. The enamel (neo chlorofluorocarbon ND-2) of tetrafluoroethylene

hexafluoropropylene is applied, heat treatment is performed at 360 \*\*, and the coat material 10 from which thickness is set to 50 micrometers is coated. The 30-micrometer-thick catalyst bed 2a and 2b are applied to the gas diffusion electrodes 1a and 1b, a hotpress is carried out with the solid polymer membrane 3 on the same conditions as a 1st embodiment, and it is held with the separator 5.

[0050][Function and Effect] — according to a 7th embodiment that has account composition of a top, gas separating performance of coat material 10 improves the end of the solid polymer membrane 3 by that of a wrap. It is not necessary to provide separately the sealant [ bolting / a sealant ], and since it becomes equivalent [ load ], generating of the local shearing stress of the solid polymer membrane 3 is prevented, the fracture of solid polymer membrane is prevented certainly, and cross leakage can be prevented. It checked that the gas-seal function was specifically maintained for 10,000 hours. According to such this embodiment, since gas-seal performance improves, the improvement in reliability of a solid polyelectrolyte type fuel cell, reinforcement, and the improvement in reliability are attained.

[0051](8) An 8th embodiment [ 8th ] of an embodiment [composition] is Claim 9 and a thing corresponding to 10, As shown in drawing 15, the direction of the width dimension of the coat material 10 with which the cathode terminal 1b side was coated was set up for a long time than the width dimension of the coat material 10 with which the anode electrode 1a side was coated.

[0052][Function and Effect] — in an 8th embodiment with the account composition of a top, supply by the side of the cathode of the proton generated by the anode side can be smoothly performed as well as a 3rd embodiment of the above. Therefore, in order for the case where the time of application-of-pressure operation and electrode differential pressure increase etc. to raise seal performance, even when the width dimension of the coating portion of the coat material 10 is made to increase, inhibition of supply to the cathode side of the proton generated with the anode is prevented, and the corrosion of an electrode can be prevented. According to this embodiment, when seal performance needs to be improved, corrosion can be prevented and the reliability of the cell of a solid polyelectrolyte type fuel cell increases.

[0053](9) A 9th embodiment [ 9th ] of an embodiment [composition] corresponds to Claim 11, and drawing 16 is a sectional view showing the cell structure of a 9th embodiment. As shown in drawing 16, the ink 11 which consists of carbon powder (Vulcan XC-72R), surface activity material, and pure water is applied to the end of the gas diffusion electrodes 1a and 1b which applied the catalyst bed 2a and 2b (67% of solid content), and a drying process is carried out to it at 120 \*\*. Then, the solid polymer membrane 3 and a hotpress are performed on the same conditions as a 1st embodiment, and it is held with the separator 5.

[0054][Function and Effect] — in a 9th embodiment that has the composition of the account of a top, hydrophilic processing of the end of the gas diffusion electrodes 1a and 1b can be carried out by the ink 11 which consists of carbon being impregnated. Furthermore, at the end of the electrodes 1a and 1b, since electrochemical reaction does not arise, compared with a reaction part, temperature becomes low. That is, by supplying the humidification gas whose relative humidity is 100% to the end of the electrodes 1a and 1b at the temperature of a reaction part, condensation of water will arise at the electrode 1a and the 1b end, and a wet seal will always be carried out. Therefore, it is not necessary to provide separately the seal part [ bolting / a seal part / a sealant ], and load is also equivalent. Therefore, the local shearing stress in the solid polymer membrane 3 does not occur, but the fracture of the solid polymer membrane 3 can be prevented. Specifically, it checked that the gas-seal function was maintained for 10,000 hours. According to these above embodiments, gas-seal performance improves and the improvement in reliability of a solid polyelectrolyte type fuel cell and reinforcement are attained.

[0055](10) A 10th embodiment [ 10th ] of an embodiment [composition] is a thing corresponding to Claim 12, As shown in drawing 17, the width dimension of the ink 11 of the end by the side of the cathode terminal 1b was set up for a long time than the width dimension of the ink 11 of an impregnating [ at the anode electrode 1a side ] end.

[0056][Function and Effect] — in a 10th embodiment of the account of a top, Since supply by the side of the cathode of the proton generated by the anode side can be smoothly performed as well as 3rd and 8th embodiments of the above, It can do, even when the width dimension of

the ink 11 is made to increase, preventing inhibition of supply to the cathode side of the proton generated with the anode, and preventing the corrosion of an electrode. According to this embodiment, when seal performance needs to be improved, corrosion can be prevented and the reliability of the cell of a solid polyelectrolyte type fuel cell increases.

[0057](11) Although the tetrafluoroethylene perfluoroalkyl vinyl ether copolymer (PFA) was used as the sheets 9 and 91 in other embodiments which carried out embodiment \*\*\*\*, the sheet of fluoro-resins and Viton rubbers, such as polytetrafluoroethylene (PTFE) and a tetrafluoroethylene hexafluoropropylene copolymer (FEP), and the product made of silicone rubber otherwise -- business -- a potato is good. As the coat material 10, even if it uses polytetrafluoroethylene enamel and glass coat material, there is same effect. Instead of applying coat material, polytetrafluoroethylene (PTFE), The same effect can be acquired even if it carries out thermal melting arrival of the sheet of a tetrafluoroethylene hexafluoropropylene copolymer (FEP) or a tetrafluoroethylene perfluoroalkyl vinyl ether copolymer (PFA).

[0058]

[Effect of the Invention]The shearing stress by the sealant which is generated at the time of stack bolting [ / near the seal part of solid polymer membrane ] according to this invention as explained above, By reducing the shearing stress resulting from the expansion accompanying change of the temperature of the solid polyelectrolyte membrane at the time of a load change, and water content, and contraction at the time of deactivation and storage, The cross leakage by the fracture of the film accompanying degradation of temporal solid polyelectrolyte membrane is prevented, and since it is possible to raise gas-seal performance, a solid polyelectrolyte type fuel cell with high reliability in which long-term operation is possible can be obtained.

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TECHNICAL FIELD

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[Field of the Invention]This invention relates to the solid polyelectrolyte type fuel cell which used solid polymer membrane as an electrolyte, and relates to what added improvement to gas sealing structure especially.

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PRIOR ART

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[Description of the Prior Art]In recent years, the fuel cell which used the electrochemical reaction by fuel, such as hydrogen, and oxidizers, such as oxygen, as a device which transforms into electrical energy directly the chemical energy which fuel has attracts attention. Although various types are proposed by this fuel cell, the solid polyelectrolyte type fuel cell which used solid polymer membrane for the electrolyte is known as one of them. Drawing 18 and drawing 19 are what showed the composition of the solid polyelectrolyte type fuel cell, and explain this composition below.

[0003]As shown in a figure, the gas diffusion electrode (product made from porous carbon) of the couple which consists of the anode electrode 1a and the cathode terminal 1b is provided in the solid polyelectrolyte type fuel cell, and the catalyst bed 2a with a thickness of 30 micrometers which consists of Pt(s) etc., respectively, and 2b are formed in each electrodes 1a and 1b. The solid polymer membrane 3 is formed as an electrolyte layer, and this film 3 is pinched by the electrodes 1a and 1b via the catalyst bed 2a and 2b, and is made and arranged. The cell 4 comprises these electrodes 1a and 1b and the solid polymer membrane 3.

[0004]As the cell 4 is inserted, the gas impermeability separator 5 is installed. The gas distribution groove for supplying fuel gas, such as hydrogen, to the anode electrode 1a, and supplying oxidant gas, such as oxygen, to the cathode terminal 1b, respectively is formed in the separator 5. Between the solid polymer membrane 3 and the separator 5, the sealant 8 made of Viton rubber which touches the peripheral part of the electrodes 1a and 1b is installed. The sealant 8 prevented the gas leak to the outside of a system, and has achieved the work which avoids the danger of explosion by combustible gas, such as decline in the rate of gas utilization, and hydrogen.

[0005]There are a perfluoro sulfonic acid film etc. which are for example, fluorine system ion-exchange membranes as the above-mentioned solid polymer membrane 3. The solid polymer membrane 3 has an exchange group of a hydrogen ion in a molecule, and functions as an ion-conductive substance by carrying out saturation water. The solid polymer membrane 3 also has the gas separating function to separate the electrodes 1a and 1b, the fuel gas supplied, and oxidant gas, prevents the electrode 1a and the sag by the cross leakage (mixing of fuel gas and oxidant gas) between 1b, and makes a cell operate in the long run.

[0006]In the solid polyelectrolyte type fuel cell which has the above composition, by supplying fuel gas, such as hydrogen, to the anode electrode 1a, and supplying oxidant gas, such as oxygen, to the cathode terminal 1b, electrochemical reaction occurs and electromotive force arises in the cell 4. The gas supplied to the electrodes 1a and 1b is humidified so that the relative humidity in the cell 4 may be 100%. This is for preventing the desiccation of the solid polymer membrane 3 which causes aggravation of ion conductivity.

[0007]By the way, after making the cell 4 into the cell layered product 6 (it illustrates to drawing 18) by which plural laminates were carried out via the separator 5 since the electromotive force of the cell 4 was usually as low as less than 1V when a solid polyelectrolyte type fuel cell is actually used, it is used as a cell stack. At this time, the cold plate 7 which circulates a refrigerant is inserted every cell layered product 6, and the surplus heat generated in connection with electrochemical reaction by work of the cold plate 7 is removed.

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## EFFECT OF THE INVENTION

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[Function and Effect] -- in a 1st embodiment that has the composition of the account of a top, the sheet 9 made to pinch in the seal part of the cell 4 can cover the solid polymer membrane 3, and the shearing stress applied near the seal part can be reduced. Therefore, it can prevent the solid polymer membrane 3 fracturing. and since it is a product made from PFA, its intensity is strong, and since it excels in endurance, the sheet 9 can assist the gas disassembler of the film 3, and the reliability of a gas-seal function boils it markedly, and improves. More specifically, it checked that the gas-seal function was maintained for at least 10,000 hours. According to such a 1st embodiment, since gas-seal performance improves, it becomes possible to attain improvement in reliability of a solid polyelectrolyte type fuel cell, and reinforcement. Even if it pinches the sheet 9 like drawing 3 as a modification of a 1st embodiment to the interface of the gas diffusion electrodes 1a and 1b, the catalyst bed 2a, and 2b, the same operation effect is obtained.

[0037](2) A 2nd embodiment [ 2nd ] of an embodiment [composition] is Claim 2 and a thing corresponding to 7, The upper surface or the undersurface of the separator 5 is touched, and it is applied to the solid polyelectrolyte type fuel cell with which the sealant 8 has been arranged as the peripheral part of the solid polymer membrane 3 and the gas diffusion electrodes 1a and 1b was touched. The direction of the solid polymer membrane 3 of an embodiment is not extended to a seal part, but the point of difference of such an embodiment and a 1st embodiment of the above is at the point that reduction of the operating area is carried out. According to a 2nd embodiment, as shown in the sectional view of drawing 4, it is characterized by having inserted the sheet 9, having made and having been arranged from between the sealant 8 of a couple, and eight comrades, over the solid polymer membrane 3, and the catalyst bed 2a of the gas diffusion electrodes 1a and 1b and 2b.

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TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention]There was a problem which is raised to the next in the above-mentioned solid polyelectrolyte type fuel cell. Although the temperature and water content of the solid polymer membrane 3 change at the time of a load change at the time of the deactivation of a fuel cell, and storage, it may follow on this change, the solid polymer membrane 3 may expand or contract, and shearing stress may arise in the solid polymer membrane 3. In addition, since the solid polyelectrolyte type fuel cell was used as a cell stack as the preceding paragraph described, shearing stress occurred into the portion to which the seal of the solid polymer membrane 3 is carried out by the sealant 8 at the time of stack bolting.

[0009]When shearing stress arose in the solid polymer membrane 3 and still more nearly temporal degradation followed, there was a possibility that the solid polymer membrane 3 might fracture. If the solid polymer membrane 3 fractured, the cross leakage of fuel gas and oxidant gas occurred, voltage fell remarkably, and the fault that the driving continuation of a cell became impossible arose.

[0010]This invention is proposed in order to cancel such a problem, and it is a thing. the purpose is to provide a solid polyelectrolyte type fuel cell with high reliability in which long-term operation is possible by reducing the shearing stress boiled and produced, preventing the cross leakage by membranous fracture, and raising gas-seal performance.

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MEANS

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[Means for Solving the Problem]In order to attain the above-mentioned purpose, a solid polyelectrolyte type fuel cell corresponding to Claim 1, A gas diffusion electrode of a couple which consists of a cathode terminal and an anode electrode as solid polymer membrane is provided as an electrolyte layer and sandwiches said solid polymer membrane is arranged, As said gas diffusion electrode is inserted, a separator of a gas impermeability couple is installed, In a solid polyelectrolyte type fuel cell with which a sealant of a couple has been arranged as it was furthermore inserted into said solid polymer membrane and said separator and a peripheral part of said gas diffusion electrode was touched, It is characterized [ constitutional ] by having been inserted into said solid polymer membrane, said sealant, and said solid polymer membrane and said gas diffusion electrode, and having arranged a sheet.

[0012]In an invention of Claim 1 which has the above-mentioned composition, a sheet is that of a wrap about a solid polymer membrane, shearing stress to solid polymer membrane by a sealant can be reduced, and a membranous fracture can be prevented. And a sheet can assist gas separating performance of solid polymer membrane. Therefore, the reliability of a gas-seal function improves.

[0013]A solid polyelectrolyte type fuel cell corresponding to Claim 2, A gas diffusion electrode of a couple which consists of a cathode terminal and an anode electrode as solid polymer membrane is provided as an electrolyte layer and sandwiches said solid polymer membrane is arranged, As said gas diffusion electrode is inserted, a separator of a gas impermeability couple is installed, In a solid polyelectrolyte type fuel cell with which the upper surface or the undersurface of said separator was furthermore touched, and a sealant of a couple has been arranged as a peripheral part of said solid polymer membrane and said gas diffusion electrode was touched, It was inserted into sealants, and said solid polymer membrane and said gas diffusion electrode of said couple, and a sheet has been arranged.

[0014]Since a sealant is arranged in an invention of Claim 2 which has the above-mentioned composition so that a peripheral part of solid polymer membrane may be touched, Cost reduction by reduction of area of solid polymer membrane is possible, and the same operation effect as an invention of Claim 1 can be demonstrated in such a solid polyelectrolyte type fuel cell.

[0015]A solid polyelectrolyte type fuel cell corresponding to Claim 3 was set up in the solid polyelectrolyte type fuel cell according to claim 1 or 2 for a long time than a width dimension of said sheet in which a direction of a width dimension of said sheet arranged at said cathode terminal side has been arranged at said anode electrode side.

[0016]In an invention of Claim 3 which has the above-mentioned composition, since a width dimension of a sheet arranged at the cathode terminal side is made longer than a width dimension of a sheet arranged at the anode electrode side, supply by the side of a cathode terminal of a proton generated by the anode electrode side is not checked. Therefore,  $C+2H_2O \rightarrow CO_2 + 4H^+$  Corrosion of an electrode by the reaction  $+4e^-$  can be prevented. That is, when width of a sheet arranged at a gas diffusion electrode is made to increase, the gas-seal performance can be improved and the time of application-of-pressure operation and electrode differential pressure increase, preventing corrosion of an electrode, it can respond.

[0017]A solid polyelectrolyte type fuel cell corresponding to Claim 4, A gas diffusion electrode of

a couple which consists of a cathode terminal and an anode electrode as solid polymer membrane is provided as an electrolyte layer and sandwiches said solid polymer membrane is arranged, In a solid polyelectrolyte type fuel cell with which a separator of a gas impermeability couple was installed as sandwiched said gas diffusion electrode, as it was inserted into said solid polymer membrane and said separator and an end of said gas diffusion electrode was covered, a sheet of KO type has been arranged for a section.

[0018]In an invention of Claim 4 carried out to the above-mentioned composition, some sheets of KO type can realize improvement in membranous prevention from a fracture, and gas separating performance for solid polymer membrane by that of a wrap. And it is not necessary to provide separately a sealant [ bolting / a sealant ], and since load is also equivalent, it is possible to reduce local shearing stress of solid polymer membrane substantially.

[0019]A solid polyelectrolyte type fuel cell corresponding to Claim 5, In a portion which touches said solid polymer membrane of a sheet of said KO type, a direction of a width dimension of a portion arranged at said cathode terminal side is the solid polyelectrolyte type fuel cell according to claim 4 setting up for a long time than a width dimension of a portion arranged at said anode electrode side.

[0020]In an invention of Claim 5 which has such composition, preventing corrosion generating of an electrode by supply inhibition by the side of a cathode of a proton generated by the anode side like an invention of above-mentioned Claim 3, width of a sheet arranged at a gas diffusion electrode is made to increase, and gas-seal performance can be improved.

[0021]A solid polyelectrolyte type fuel cell corresponding to Claim 6, In the solid polyelectrolyte type fuel cell according to claim 1, 2, 3, 4, or 5, a catalyst bed which touches said solid polymer membrane is provided in said gas diffusion electrode, and it was constituted so that said sheet might touch a peripheral part of said catalyst bed.

[0022]Since a sheet is constituted so that a peripheral part of a catalyst bed may be touched, thickness of a sheet can be made to increase even to the same grade as thickness of a catalyst bed in an invention of Claim 6 which has such composition. Therefore, the tolerance of intensity in a sheet or electrode differential pressure can be improved, and the reliability of a gas-seal function improves.

[0023]In Claims 1, 2, 3 and 4 and a solid polyelectrolyte type fuel cell given in 5 and 6, as for a solid polyelectrolyte type fuel cell corresponding to Claim 7, said sheet comprised a fluoro-resin. Since a fluoro-resin is excellent in heat resistance, acid resistance, and a water resisting property, it can aim at improvement in the endurance of a sheet by having the above-mentioned composition.

[0024]A solid polyelectrolyte type fuel cell corresponding to Claim 8, A gas diffusion electrode of a couple which consists of a cathode terminal and an anode electrode as solid polymer membrane is provided as an electrolyte layer and sandwiches said solid polymer membrane is arranged, An end of said gas diffusion electrode was coated with coat material in a solid polyelectrolyte type fuel cell with which a separator of a gas impermeability couple was installed as sandwiched said gas diffusion electrode.

[0025]Since coat material can cover an end of solid polymer membrane according to the invention of Claim 8 of the above-mentioned composition, improvement in gas separating performance can be aimed at. Since it becomes do not need to provide separately a sealant [ bolting / a sealant ] and equivalent [ load ], generating of local shearing stress of solid polymer membrane is prevented, and a fracture of solid polymer membrane can be prevented.

[0026]A solid polyelectrolyte type fuel cell corresponding to Claim 9, A direction of a width dimension of said coat material with which said cathode terminal side was coated is the solid polyelectrolyte type fuel cell according to claim 8 setting up for a long time than a width dimension of said coat material with which said anode electrode side was coated.

[0027]In an invention of Claim 9 which it has, the above-mentioned composition as well as above-mentioned Claim 3 and an invention of 5, Since supply by the side of a cathode of a proton generated by the anode side is performed smoothly, an electrode does not corrode, width of coat material arranged at a gas diffusion electrode is made to fully increase, and gas-seal performance can be improved.

[0028]A solid polyelectrolyte type fuel cell corresponding to Claim 10 is characterized by said coat material comprising a fluoro-resin or a charge of a glass seal material in the solid polyelectrolyte type fuel cell according to claim 8 or 9. In an invention which has such composition, acid resistance and heat resistance of a coating part improve, and there is a operation effect that gas-seal performance increases.

[0029]A solid polyelectrolyte type fuel cell corresponding to Claim 11, A gas diffusion electrode of a couple which consists of a cathode terminal and an anode electrode as solid polymer membrane is provided as an electrolyte layer and sandwiches said solid polymer membrane is arranged, In a solid polyelectrolyte type fuel cell with which a separator of a gas impermeability couple was installed as sandwiched said gas diffusion electrode, ink which has carbon powder and water at least at the end of said gas diffusion electrode was applied, and it was impregnated.

[0030]In an invention of Claim 11 which has the above-mentioned composition, hydrophilic processing of the end of a gas diffusion electrode can be carried out by ink which has carbon powder and water at least being impregnated. Furthermore, at the end of an electrode, since electrochemical reaction does not arise, compared with a reaction part, temperature becomes low. That is, by supplying humidification gas whose relative humidity is 100% to an electrode end part at temperature of a reaction part, in an electrode end part, condensation of water will arise and a wet seal will always be carried out. Therefore, it is not necessary to provide separately a seal part [ bolting / a seal part / a sealant ], and load is also equivalent. Therefore, local shearing stress of solid polymer membrane does not occur, but a fracture of solid polymer membrane can be prevented.

[0031]A solid polyelectrolyte type fuel cell corresponding to Claim 12 is the solid polyelectrolyte type fuel cell according to claim 11, wherein a direction of a width dimension of said ink impregnated at said cathode terminal side is set up for a long time than a width dimension of said ink impregnated at said anode electrode side. By the above-mentioned composition, inhibition of supply to the cathode side of a proton generated by the anode side can be prevented like Claim 3 mentioned above and an invention of 5 and 9, and corrosion of an electrode can be prevented. Therefore, width of a sheet arranged at a gas diffusion electrode is made to increase, and gas-seal performance can be improved.

[0032]

[Embodiment of the Invention]Hereafter, an example of an embodiment of the invention is concretely explained with reference to Drawings. Identical codes are attached about the same member as the conventional technology shown by drawing 18 and drawing 19, and explanation is omitted.

[0033](1) A 1st embodiment [ 1st ] of an embodiment [composition] is Claim 1 and a thing corresponding to 7, It is applied to the solid polyelectrolyte type fuel cell with which the sealant 8 has been arranged as it was inserted into the solid polymer membrane 3 and the separator 5 and the peripheral part of the gas diffusion electrodes 1a and 1b was touched like the conventional example of drawing 19. The sectional view showing the cell structure which drawing 1 requires for a 1st embodiment, and drawing 2 are the exploded views showing cell structure.

[0034]As shown in drawing 1, from between the solid polymer membrane 3 and the sealants 8, covering the interface between the solid polymer membrane 3, and the catalyst bed 2a of the gas diffusion electrodes 1a and 1b and 2b, the sheet 9 is inserted, and it is made and arranged. The sheet 9 consists of a 25-micrometer-thick tetrafluoroethylene perfluoroalkyl vinyl ether copolymer (PFA), and a hotpress is carried out for 15 minutes by the temperature of 120 \*\*, and press pressure 20 kgf/cm<sup>2</sup>.

[0035]As shown in drawing 2, the gas distribution groove 13 for supplying fuel gas, such as hydrogen, to the anode electrode 1a, and supplying oxidant gas, such as oxygen, to the cathode terminal 1b, respectively is formed in the separator 5. The object for fuel gas, the object for oxidant gas, and the manifolds 12a, 12b, and 12c for cooling water are formed in the seal part in each member, respectively.

[Translation done.]

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1]The sectional view showing the cell structure concerning a 1st embodiment of this invention

[Drawing 2]The exploded view showing the cell structure of drawing 1

[Drawing 3]The sectional view of the modification of a 1st embodiment

[Drawing 4]The sectional view showing the cell structure concerning a 2nd embodiment of this invention

[Drawing 5]The sectional view showing the cell structure concerning a 3rd embodiment of this invention

[Drawing 6]The sectional view showing the cell structure concerning a 4th embodiment of this invention

[Drawing 7]The exploded view showing the cell structure of drawing 6

[Drawing 8]The sectional view showing the cell structure concerning a 5th embodiment of this invention

[Drawing 9]The sectional view of the modification of a 5th embodiment

[Drawing 10]The sectional view of the modification of a 5th embodiment

[Drawing 11]The sectional view of the modification of a 5th embodiment

[Drawing 12]The sectional view showing the cell structure concerning a 6th embodiment of this invention

[Drawing 13]The sectional view of the modification of a 6th embodiment

[Drawing 14]The sectional view showing the cell structure concerning a 7th embodiment of this invention

[Drawing 15]The sectional view showing the cell structure concerning an 8th embodiment of this invention

[Drawing 16]The sectional view showing the cell structure concerning a 9th embodiment of this invention

[Drawing 17]The sectional view showing the cell structure concerning a 10th embodiment of this invention

[Drawing 18]The sectional view of the conventional solid polyelectrolyte type fuel cell layered product

[Drawing 19]The sectional view showing the cell structure of the conventional solid polyelectrolyte type fuel cell

[Description of Notations]

1a -- Gas diffusion electrode (anode)

1b -- Gas diffusion electrode (cathode)

2a -- Catalyst bed (anode)

2b -- Catalyst bed (cathode)

3 -- Solid polymer membrane

4 -- Cell

5 -- Separator

6 -- Cell layered product

- 7 --- Cold plate
- 8 --- Sealant
- 9, 91 --- Sheet
- 10 --- Coat material
- 11 --- Ink
- 12a --- Manifold (for fuel gas)
- 12b --- Manifold (for oxidant gas)
- 12c --- Manifold (for cooling water)
- 13 --- Gas distribution groove

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[Translation done.]

## \* NOTICES \*

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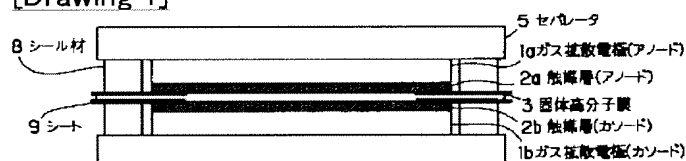
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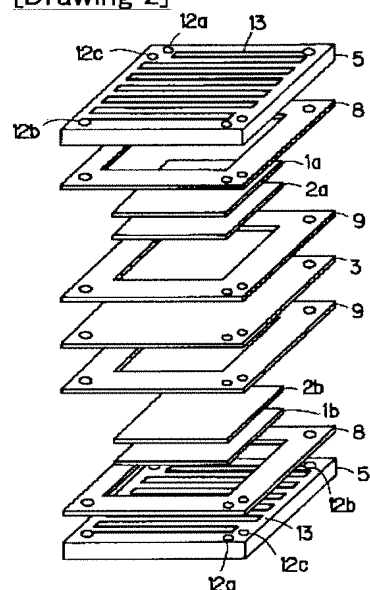
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## DRAWINGS

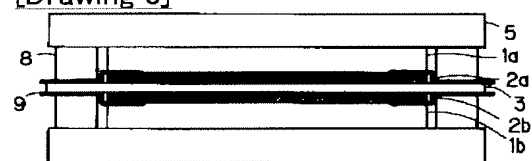
[Drawing 1]



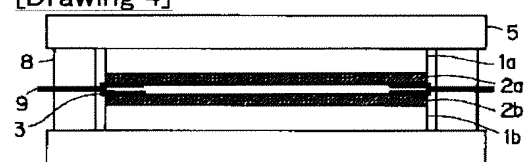
[Drawing 2]



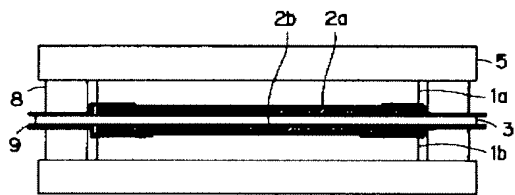
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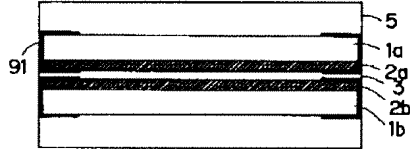
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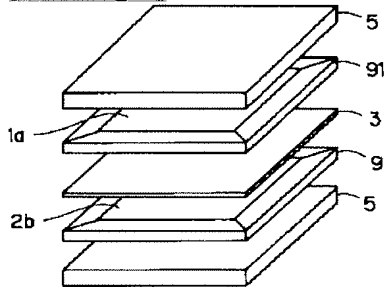
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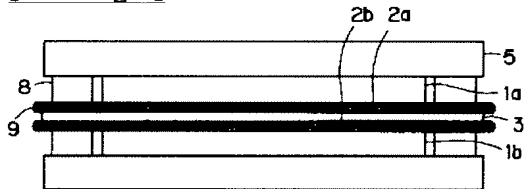
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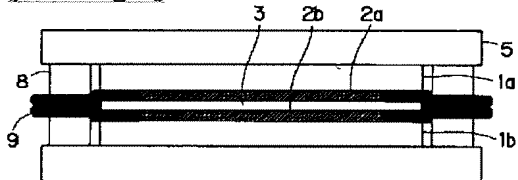
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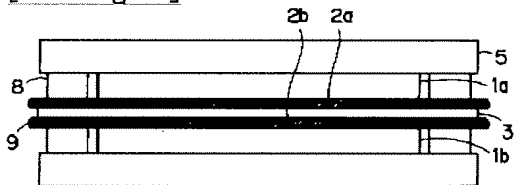
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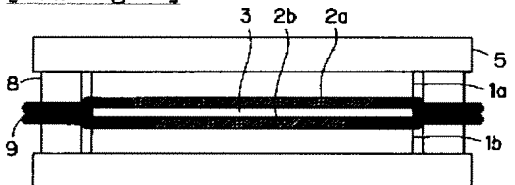
[Drawing 9]



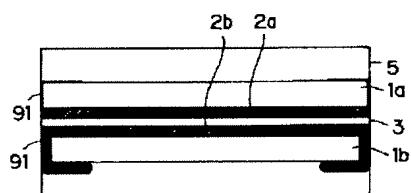
[Drawing 10]



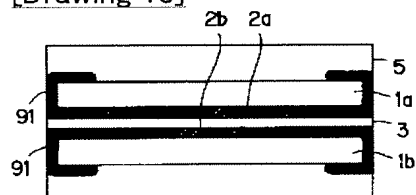
[Drawing 11]



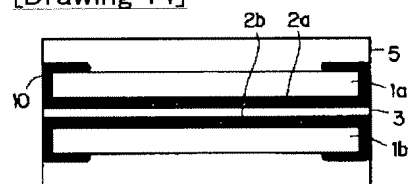
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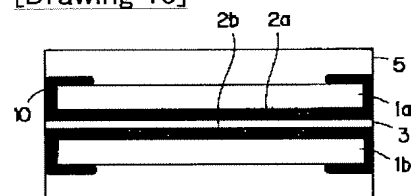
[Drawing 13]



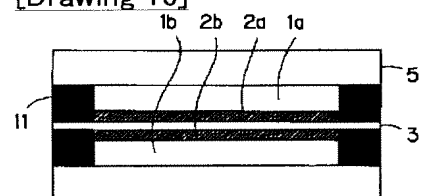
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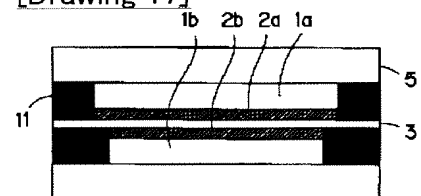
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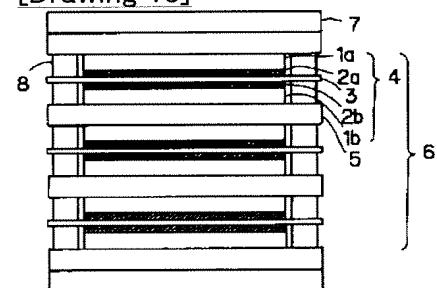
[Drawing 16]



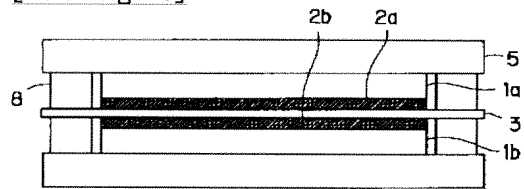
[Drawing 17]



[Drawing 18]



[Drawing 19]



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[Translation done.]